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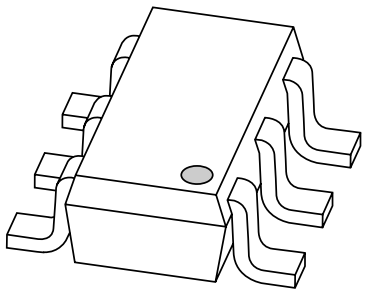
# DATA SHEET



# PBSS4140DPN

## 40 V low $V_{CEsat}$ NPN/PNP transistor

Product specification

2001 Dec 13

Philips Semiconductors

PHILIPS

# 40 V low $V_{CEsat}$ NPN/PNP transistor PBSS4140DPN

## FEATURES

- 600 mW total power dissipation
- Low collector-emitter saturation voltage
- High current capability
- Improved device reliability due to reduced heat generation
- Replaces two SOT23 packaged low $V_{CEsat}$ transistors on same PCB area
- Reduces required PCB area
- Reduced pick and place costs.

## APPLICATIONS

- General purpose switching and muting
- LCD backlighting
- Supply line switching circuits
- Battery driven equipment (mobile phones, video cameras and hand-held devices).

## DESCRIPTION

NPN/PNP low $V_{CEsat}$ transistor pair in an SC-74 (SOT457) plastic package.

## MARKING

| TYPE NUMBER | MARKING CODE |
|---|---|
| PBSS4140DPN | M2 |

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | MAX. | UNIT |
|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | 40 | V |
| $I_C$ | peak collector current | 1 | A |
| $I_{CM}$ | peak collector current | 2 | A |
| TR1 | NPN | – | – |
| TR2 | PNP | – | – |
| $R_{CEsat}$ | equivalent on-resistance | <500 | mΩ |

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1, 4 | emitter TR1; TR2 |
| 2, 5 | base TR1; TR2 |
| 6, 3 | collector TR1; TR2 |

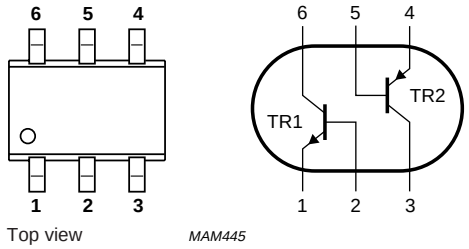



Fig.1 Simplified outline SC74 (SOT457) and symbol.

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| **Per transistor; for the PNP transistor with negative polarity** | | | | | |
| $V_{CBO}$ | collector-base voltage | open emitter | – | 40 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | 40 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 5 | V |
| $I_C$ | collector current (DC) | | – | 1 | A |
| $I_{CM}$ | peak collector current | | – | 2 | A |
| $I_{BM}$ | peak base current | | – | 1 | A |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C; note 1 | – | 370 | mW |
| $T_{stg}$ | storage temperature | | −65 | +150 | °C |
| $T_j$ | junction temperature | | – | 150 | °C |
| $T_{amb}$ | operating ambient temperature | | −65 | +150 | °C |
| **Per device** | | | | | |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C; note 1 | – | 600 | mW |

**Note**

1. Device mounted on a printed-circuit board, single side copper, tinplated, mounting pad for collector 1 $cm^2$.

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}a}$ | thermal resistance from junction to ambient | in free air; note 1 | 208 | K/W |

**Note**

1. Device mounted on a printed-circuit board, single side copper, tinplated, mounting pad for collector 1 $cm^2$.

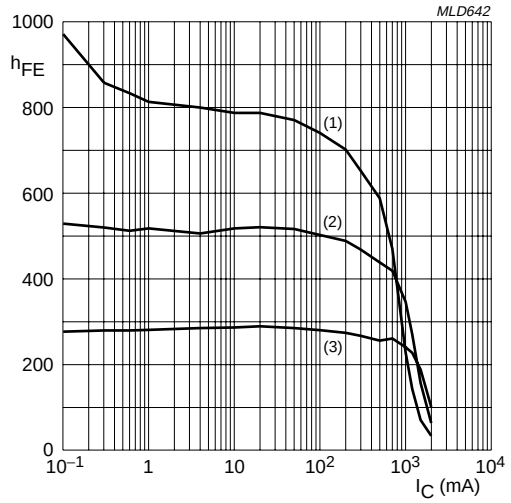
## CHARACTERISTICS

$T_{amb}$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| **Per transistor unless otherwise specified; for the PNP transistor with negative polarity** | | | | | | |
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 40 V; $I_E$ = 0 | – | – | 100 | nA |
| | | $V_{CB}$ = 40 V; $I_E$ = 0; $T_j$ = 150 °C | – | – | 50 | µA |
| $I_{CEO}$ | collector-emitter cut-off current | $V_{CE}$ = 30 V; $I_B$ = 0 | – | – | 100 | nA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 5 V; $I_C$ = 0 | – | – | 100 | nA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 1 mA | 300 | – | – | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 100 mA; $I_B$ = 1 mA | – | – | 200 | mV |
| | | $I_C$ = 500 mA; $I_B$ = 50 mA | – | – | 250 | mV |
| | | $I_C$ = 1 A; $I_B$ = 100 mA | – | – | 500 | mV |
| **NPN transistor** | | | | | | |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 500 mA | 300 | – | 900 | |
| | | $V_{CE}$ = 5 V; $I_C$ = 1 A | 200 | – | – | |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = 1 A; $I_B$ = 100 mA | – | – | 1.2 | V |
| $V_{BEon}$ | base-emitter turn-on voltage | $V_{CE}$ = 5 V; $I_C$ = 1 A | – | – | 1.1 | V |
| $R_{CEsat}$ | equivalent on-resistance | $I_C$ = 500 mA; $I_B$ = 50 mA; note 1 | – | 260 | <500 | mΩ |
| $f_T$ | transition frequency | $V_{CE}$ =10 V; $I_C$ = 50 mA; f = 100 MHz | 150 | – | – | MHz |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = $I_e$ = 0; f = 1 MHz | – | – | 10 | pF |
| **PNP transistor** | | | | | | |
| $h_{FE}$ | DC current gain | $V_{CE}$ = –5 V; $I_C$ = –100 mA | 300 | – | 800 | |
| | | $V_{CE}$ = –5 V; $I_C$ = –500 mA | 250 | – | – | |
| | | $V_{CE}$ = –5 V; $I_C$ = –1 A | 160 | – | – | |
| $V_{BEsat}$ | base-emitter saturation voltage | $I_C$ = –1 A; $I_B$ = –50 mA | – | – | –1.1 | V |
| $V_{BEon}$ | base-emitter turn-on voltage | $V_{CE}$ = –5 V; $I_C$ = –1 A | – | – | –1.0 | V |
| $R_{CEsat}$ | equivalent on-resistance | $I_C$ = –500 mA; $I_B$ –50 mA; note 1 | – | 300 | <500 | mΩ |
| $f_T$ | transition frequency | $V_{CE}$ = –10 V; $I_C$ = –50 mA; f = 100 MHz | 150 | – | – | MHz |
| $C_c$ | collector capacitance | $V_{CB}$ = –10 V; $I_E$ = $I_e$ = 0; f =1 MHz | – | – | 12 | pF |

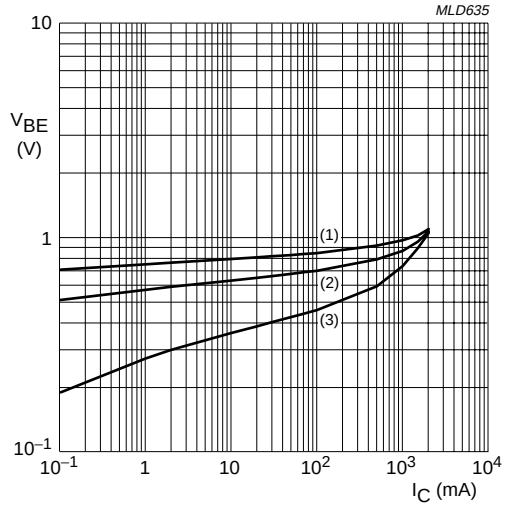
**Note**

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.



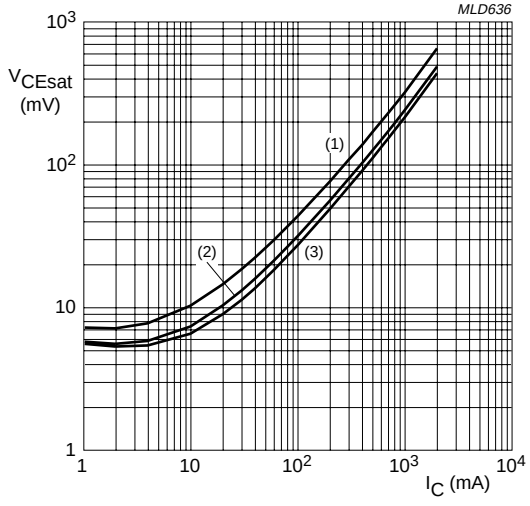

**TR1 (NPN);** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.2 DC current gain as a function of collector current; typical values.



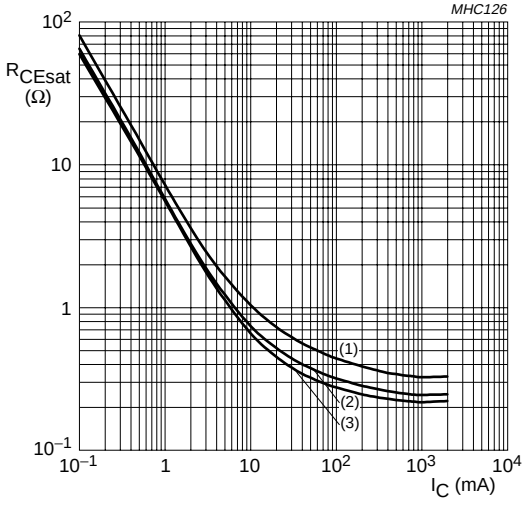

**TR1 (NPN);** $V_{CE}$ = 5 V.
(1) $T_{amb}$ = –55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

Fig.3 Base-emitter voltage as a function of collector current; typical values.



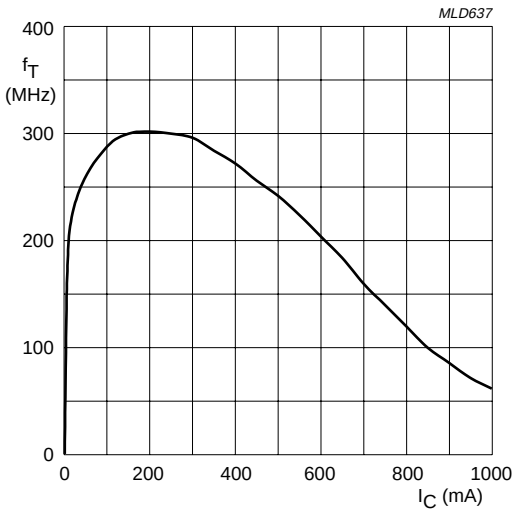

**TR1 (NPN);** $I_C/I_B$ = 10.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.4 Collector-emitter saturation voltage as a function of collector current; typical values.



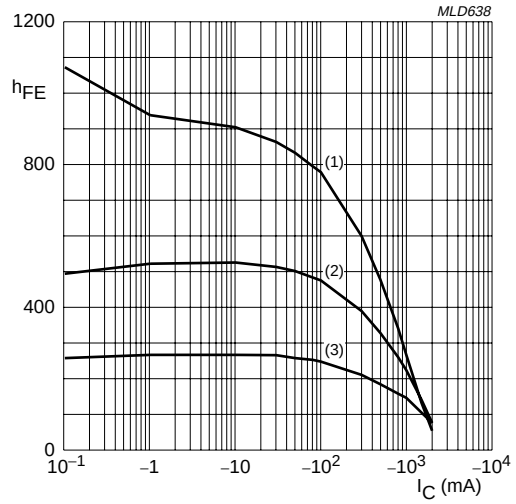

**TR1 (NPN);** $I_C/I_B$ = 10.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = –55 °C.

Fig.5 Equivalent on-resistance as a function of collector current; typical values.



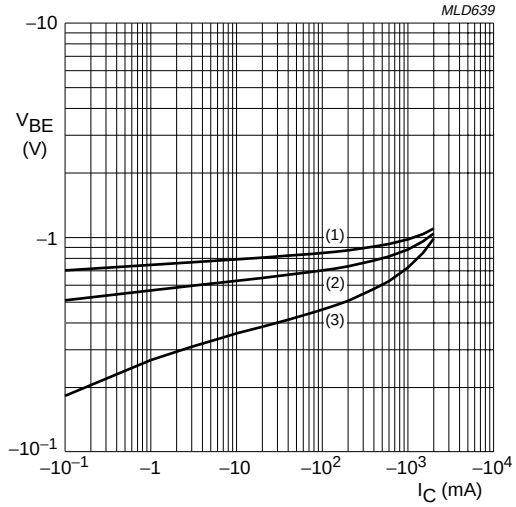

**TR1 (NPN);** $V_{CE}$ = 10 V.

Fig.6 Transition frequency as a function of collector current; typical values.



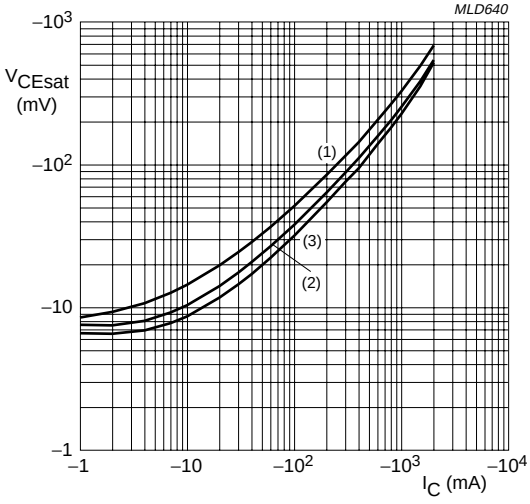

**TR2 (PNP);** $V_{CE}$ = −5 V.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig.7 DC current gain as a function of collector current; typical values.



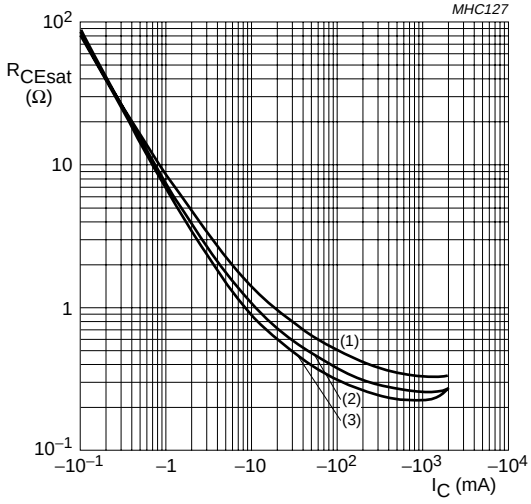

**TR2 (PNP);** $V_{CE}$ = −5 V.
(1) $T_{amb}$ = −55 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = 150 °C.

Fig.8 Base-emitter voltage as a function of collector current; typical values.



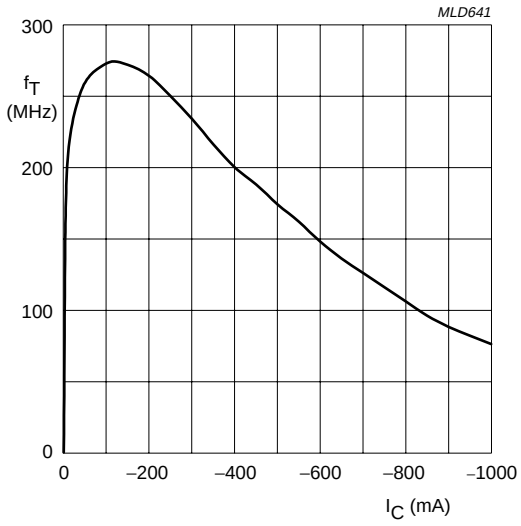

**TR2 (PNP);** $I_C/I_B$ = 10.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig.9 Collector-emitter saturation voltage as a function of collector current; typical values.




**TR2 (PNP);** $I_C/I_B$ = 10.
(1) $T_{amb}$ = 150 °C.
(2) $T_{amb}$ = 25 °C.
(3) $T_{amb}$ = −55 °C.

Fig.10 Equivalent on-resistance as a function of collector current; typical values.

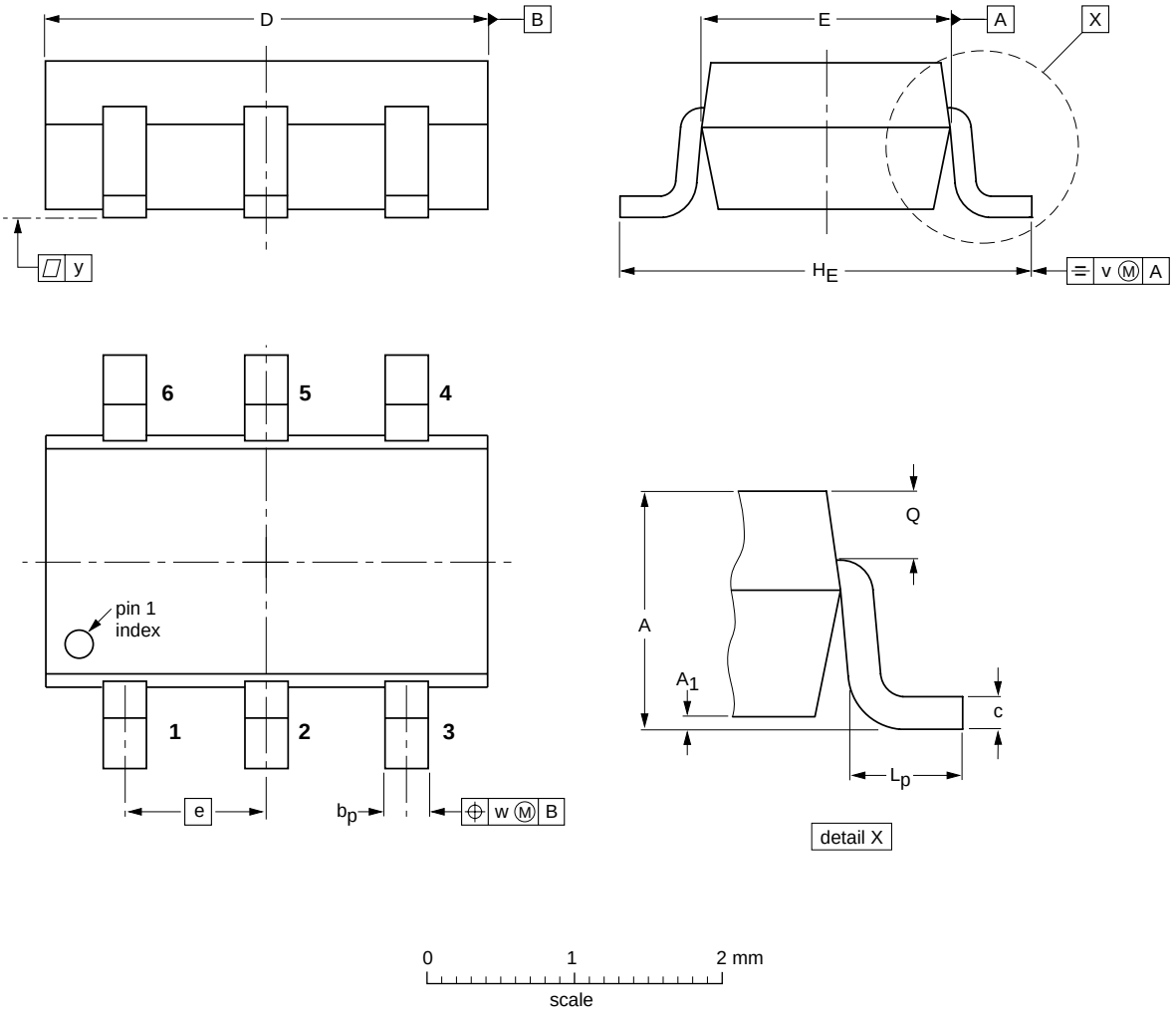



**TR2 (PNP);** $V_{CE}$ = -10 V.

Fig.11 Transition frequency as a function of collector current; typical values.

**PACKAGE OUTLINE**

**Plastic surface mounted package; 6 leads** **SOT457**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | $b_p$ | c | D | E | e | $H_E$ | $L_p$ | Q | v | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1<br>0.9 | 0.1<br>0.013 | 0.40<br>0.25 | 0.26<br>0.10 | 3.1<br>2.7 | 1.7<br>1.3 | 0.95 | 3.0<br>2.5 | 0.6<br>0.2 | 0.33<br>0.23 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT457 | | | SC-74 | | | ~~97-02-28~~<br>01-05-04 |

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